

FOREST PLANNING 5076
UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

Advisory Council



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~~Supervision~~
~~Advisory Council~~

August 25, 1930

Statement for Advisory Council of the California Forest Experiment Station

The following statement presents a condensed survey of the purpose, status, results and plans of all active projects of the Station. It is compiled in preparation for the meeting of the Council to be held in San Francisco on September 2, 1930.

FINANCIAL STATEMENT

(Fiscal Year 1930)

Income

| | | |
|------------------------------------|-----------------|-----------|
| Federal Appropriations - | | |
| Silvicultural Investigations..... | \$ 34,600.00 | |
| Soil Erosion..... | 5,000.00 | |
| Forest Survey..... | 2,000.00 | |
| Forest Products..... | 18,050.00 | |
| State Appropriations..... | 11,750.00 | |
| Southern California Agencies..... | 7,920.00 | |
| Balances in Cooperative funds..... | <u>1,780.00</u> | 80,100.00 |

Distribution of Expenditures

| | | |
|----------------------------------|------------------|-----------|
| Silviculture and Management..... | \$ 14,925.00 | |
| Cover Type Map..... | 12,700.00 | |
| Forest Influences & Erosion..... | 20,000.00 | |
| Forestation..... | 9,850.00 | |
| Extension and Cooperation..... | 2,000.00 | |
| Fire Protection..... | 2,300.00 | |
| Products Investigation..... | <u>18,325.00</u> | 80,100.00 |

FINANCIAL STATEMENT

(Fiscal Year 1931)

Income

| | |
|---|----------------------------|
| Federal Appropriations - | |
| Silvical and Management Investigations - \$ | 63,050.00 |
| Soil Erosion..... | 5,000.00 |
| Forest Survey..... | 5,000.00 |
| Forest Products..... | 18,050.00 |
| State Appropriations..... | 11,750.00 |
| Southern California Agencies..... | <u>8,020.00</u> 110,870.00 |

Proposed Expenditures

| | |
|---------------------------------|-----------------------------|
| Management Pine Region..... | \$ 19,000.00 |
| Forest Type Map..... | 16,000.00 |
| Fire Protection..... | 20,000.00 |
| Redwood..... | 10,000.00 |
| Forest Products..... | 18,050.00 |
| Forestation..... | 10,000.00 |
| Extension..... | 2,500.00 |
| Forest Influence & Erosion..... | <u>15,320.00</u> 110,870.00 |

PERSONNEL

Director)
Fire)

E. I. Kotok

Products

C. L. Hill
M. R. Brundage
I. J. Mason

Forest Management and
Reforestation

(Duncan Dunning
(A. A. Hasel
(R. B. Weaver
(E. A. Morrow

Forest Influences and
Erosion

(W. C. Lowdermilk
(C. J. Zraschel
H. L. Sundling.

Cover Type

(A. E. Wieslander
(R. C. Clark (Assigned by
State Forester

Cooperating Bureaus
Entomology
Biology

H. L. Person
E. E. Korn

Clerks

(D. H. Vanther
(F. M. Towle
(L. O. Barte
(I. Kerr
(F. Shucha

Field Assistants and Computers

26 (Part time)

Day Laborers

2

Forest Management Studies

I. Methods of Cutting

Purpose To determine the efficiency of current management and silvicultural practices in the mixed conifer forests of the Sierra Nevada, and to suggest beneficial modifications.

Status Since the beginning of the study in 1910 thirty-three sample plots have been established, varying in size from 6 to 160 acres, and distributed over seven national forests. The plots represent seven important timber types, four site qualities and three methods of cutting: light selection, heavy selection, shelterwood. *and virgin* Detailed records of reproduction and subordinate vegetation are made in 9 fenced plots, 2-3/8 miles of transects and 1780 milacre quadrats. Measurements and notes are made on 27,286 numbered trees. Complete examinations of the 33 large plots are made every five years. Most of the smaller areas are examined annually.

Cooperation in appropriate phases of the study is carried on with the federal offices of Forest Pathology, Blister Rust Control, Forest Insect Investigation, Forest Management, Range Management, Biological Survey, and with the University of California Forest School.

The most important new work of the past year was the establishment of three 15 acre plots in the yellow pine-sugar pine-white fir type in connection with the comprehensive woods-and-mill study on the Stanislaus Forest. This project is expected to give more complete data than has ever been available from any previous study with respect to the effect of different cutting methods upon the two major considerations: immediate returns to the lumber producer and the ultimate returns from future timber crops. Three cutting methods were used: standard Forest Service method; heavy cutting system as commonly used on private operations; and the so-called "economic selection system" designed to remove only species and sizes of trees estimated to return a certain margin of profit. The great amount of work involved in this study occupied most of the time of the Station's management and products forces during the year and involved cooperation with all the outside agencies previously mentioned. Detailed computations, still

under way in the office, must be completed before final analyses can be made. This study is described more in detail under Forest Products Studies.

A control plot for the study of growth and reproduction in virgin timber for comparison with cut-over areas similar in site and type, was established on the Stanislaus Forest in the sugar pine-western yellow pine-white fir type, Site I.

Two plots in the sugar pine-fir type on cut-over land were established by the Sierra Forest personnel.

Results The results of the Mc studies have been used as a basis for several revisions of Forest Service marking and logging regulations in California. The tree classification for western yellow pine, developed as a result of our studies, is now applied in timber marking practice in national forests of Oregon and Washington as well as California, and also in insect control studies. Forest management plans throughout the pine region of California are based largely upon the findings of the study. Numerous office reports have been prepared and the results published as Department bulletins and otherwise. During the year progress reports were completed for six plots and summaries prepared of the measurements on eight others. During the current season 14 of the larger plots are being measured to complete records of 20 years of growth.

Plans Complete the second general summary of the cutting studies in bulletin form. Continue examinations and progress reports at 5-year intervals. Establish new plots from time to time to represent other type, site and cutting variables. Complete compilations and analyses of data from new Stanislaus plots. A series of experimental cuttings in mixed forest will be made in the Butterfly area at the Feather River center. Three large areas in pure western yellow pine in the Modoc center will be studied to determine the influence of cutting on insect losses.

2. Natural Reproduction

Purpose To determine the major factors controlling seed bearing, seed distribution, germination, and the survival of natural seedlings as they affect silviculture, grazing and protection.

Status Data for this study are obtained chiefly from the transects and quadrats established on the various Mc plots and on clear-cut private lands. In addition screened and unscreened, fenced and unfenced plots are established to the number of 188 to determine the influence of seed supply, rodents and stock upon reproduction. Root excavation, root severance, slash disposal, seed-flight studies and nursery experiments contribute to the project. The influence of fire, bear clover and litter removal are followed on special areas. Seed bearing and seed crops are observed on the permanent Mc plots.

Plans Continue observations in various timber types. Publish results of seed flight study by H. W. Siggins, deceased. Continue root competition study and publish preliminary results of this phase. Undertake cooperation with the Biological Survey in the study of animal influences when funds become available.

3. Thinning Studies

Purpose For even-aged second growth stands in sugar pine-white fir, western yellow pine, Douglas fir and white fir types, to determine what spacing and tree-class distribution will produce the largest volume of timber of the quality desired.

Status Twenty-two plots established between 1912 and 1927, of various ages and on various sites. Measurements are made and compiled at five-year intervals from date of establishment.

Results Progress reports of early plots completed. A general summary of results for the first two 5-year periods of growth is being prepared for publication.

Plans Continue measurements and assure protection of plots from fire. Establish new plots in yellow pine on better sites when possible.

4. Slash Disposal in Mixed Conifer Types

Purpose To compare piling and burning of all logging slash with disposal of slash only on strips. Effects to be studied from standpoint of costs, fire control, and natural reproduction.

Status Two experimental areas, one on the Stanislaus and one on the Lassen National Forest, under observation in cooperation with office of Forest Pathology. Supplemented by data from methods-of-cutting plots. Report is in preparation covering effect of burning piled slash on the Lassen plots.

Results Not yet available.

3. Yield Studies

Purpose To determine yields at different ages in even-aged stands of different types and sites.

Status Data are available from four permanent plots and about 450 temporary plots in even-aged second growth stands of mixed and pure types. One plot measured in 1929 and results compiled. Analysis of mixed-types data to determine influence of stocking and composition on yield made for publication.

Results Tentative yield tables of expected growth at different ages have been constructed for western yellow pine on the east and west slopes of the Sierras. Tables prepared for Douglas fir, white fir, and red fir by the University of California, toward which the Experiment Station has contributed a small amount of data.

Plans Continue periodic measurements. Establish new plots, when possible, to complete series for important types and sites. Continue study of stocking as affecting yields.

Fire Studies

1. Shasta Fire Control Project

The most important development in the fire problem during the past year has been the designation of part of the Shasta National Forest as a "fire forest" or testing ground upon which to concentrate most of the fire research effort of both the Administrative organization and the Experiment Station.

The objectives will be, in effect: to approach the ideal of absolute elimination of fires through intensive application and critical study of known prevention, detection and suppression methods, and through the development of improvements and new methods; to determine the practicability of this near-ideal on the basis of the relation between costs and the ultimate values protected. Principles evolved by the study will be adapted and extended to other forest areas.

The project is one of joint responsibility by the Research and Administrative organizations operating under a single working plan. The Administrative organization will carry on all field projects except such incidental phases of fire control as by agreement are singled out for intensive

study. The Experiment Station will be responsible for critical observation and analysis ^{AND} for the preparation of records except those pertaining to purely administrative checks and inspections.

2. Fire Damage

Purpose To determine the damage caused by repeated summer fires on forests, restocking brushfields, and chaparral.

Status Permanent sample plots established since 1920, several large fires cruised and damage appraised. Several plots restaked in 1929.

Results Used in Department publications: Bulletin 1294 "Role of Fire in the California Pine Forests", and Circular 358 "Fire and the Forest". Data used in combating the practice of destructive "light burning".

Plans Continue observations on existing plots; establish new plots when possible in important areas.

3. Rating of Hazard

Purpose To determine the relationship of various forest types to the occurrence of fires, rate of spread and the efficacy of measures of control.

Status Detailed reports of all fires occurring in the national forests of the California region have been accumulated since 1911. These, combined with the cover-type map, constitute the source material for hazard rating studies. Fire reports are constantly being improved in accuracy and detail of significant data; the cover type map is being pushed to completion as rapidly as funds permit.

Results Department Circular 243, "Forest Fires in California", an analysis of fires from 1911 to 1920, published and results applied in national forest administration. Department Bulletin 1495, "Cover Type and Fire Control in the National Forests of Northern California", published, indicating the necessity for far greater development of forest protection effort and the lines along which this development should be concentrated.

Plans Completion of a manuscript entitled "Measures of Hour Control in Relation to Fire Control Organization". Continued improvement in the collection of fire data; completion of the cover-type map for all of California; periodic publication of fire analyses.

Cover Type Map

This project comprises the mapping of the forest and other vegetative cover types on all uncultivated lands both public and private throughout the State.

Purpose To secure data on the natural vegetation of the State as a basis for:

1. Application of research in fire, forest management, erosion, and water conservation.
2. Rating of fire hazard.
3. Inventory of forest land as a part of nation-wide survey of forest resources.
4. Determining use of land, i.e., wood production, recreation, watershed, etc.
5. Indicating possibilities of the conversion of existing types into less hazardous types with higher watershed, recreational or wood production values.

Status Mapping has been conducted since 1926 and, excluding the National Forests of Northern California, which are being mapped by the respective Forest Supervisors, 550 townships out of a total of 920 have been completed to date. This includes 3 National Parks which were mapped by Park personnel.

Results Type data secured to date have been in constant demand, even in preliminary form. They have been used as a basis for allotment of Clarke-McNary federal funds, for classification of the public domain in a report to the President's Public Domain Commission, and by the State Park Commission and some county governments.

Plans Mapping to be continued with idea of completing the entire state by 1933. It is planned to publish detailed maps on a scale of approximately $\frac{1}{2}$ inch equals one mile as color overprints on United States Geologic Survey topographic maps and also as a state-wide map on a scale of 12 miles to the inch. Speeding up of the Geological Survey mapping by increased State cooperative funds will be essential for the realization of this program.

4. Study of Going Fires

Purpose To check on the ground current suppression tactics in relation to humidity, wind, cover and topography. To develop a sound technique in measuring and evaluating the major factors which influence the spread of fires and their suppression.

Status Data have been accumulated by past Boards of Fire Review which can be used in the study. A beginning has been made on the working out of methods, particularly in securing meteorological data at going fires. Very little field work has been possible to date.

Plans Field work will be practically limited to the Shasta National Forest where fire research is being concentrated. On at least three fires observation stations must be established around and as close as possible to the fires to record the following factors: meteorological conditions, rate of spread, topography, cover types, fuel and suppression methods with special reference to the time element. Cooperation with the Regional Forest Fire Chief and with the forest fire field unit of the Weather Bureau is provided for.

5. Lightning Fires

Purpose To determine the possible existence of "lightning zones" and the possibility of predicting electric storms likely to set forest fires.

Status Partial records have been gathered at fire lookout points since 1921, and in more complete form since 1925. Improved forms for observing and recording lightning are now in use.

Results Several short papers on lightning storms and lightning fires have been published.

Plans Continue collection of data, since the basis of the study is the analysis of a large number of observations. Analyze existing data in cooperation with the Weather Bureau.

6. Controlled Burning

Purpose To determine whether annual light burning can be successfully carried on in the virgin forest within the timber belt proper. To determine the ultimate effects of the treatment.

Status The study has shown clearly the following facts:

- (1) It is impossible to secure a complete and uniform burn annually over the entire area; burning is excessive on some slopes, inadequate for the avowed purpose of the burn or altogether impossible on others.
- (2) Damage to the forest greatly exceeds the doubtful benefits of "light burning".
- (3) Cost of properly controlled burning is prohibitive.

In view of these findings the experiment is considered closed and the results will be published as soon as possible. A manuscript has been drafted but press of other work prevented publication during the past year.

7. Fuels and Weather

Purpose To determine the relationships between weather and the inflammability of forest fire fuels.

Status This is a continuing project for which the accumulation of much more data is required to make possible definite conclusions. Department Circular 354 "Weather Conditions and Forest Fires in California" summarizes results to 1923. Observations will be continued and extended as rapidly as possible in cooperation with the Weather Bureau.

8. Fire Breaks and Fire Lines

The adaptation of power machinery to the construction of fire-breaks and motor ways by the administrative organization is so rapidly changing old standards of costs and making possible the construction of so many miles of fire barriers that it has changed the perspective of this study. Aside from observation of this process it has not been possible to devote time to this study during the past year.

Forest Influence and Erosion Studies

Studies begun under this head involve attack on three scales of operation: large outdoor tank installations, hillside plots one-fortieth acre in size, and a watershed of forty acres. In addition some detailed experimentation in laboratory and field has been required for specific phases, and particularly to determine water losses from soils through transpiration of forest vegetation and direct evaporation.

1. Tank Experimentation

Purpose To isolate experimentally the role of forest litter and grasses in surface run-off, seepage and erosion.

Status A. In 1927 a battery of eight tanks, representing three soil types was set up on the Oxford Tract of the University at Berkeley to study the effect of litter alone.

B. In 1929 five additional tanks were installed to compare the effect of two types of planted grasses with that of the natural forest litter.

Both these installations are conducted in cooperation with the University of California Forest School.

C. A third series of five tanks was set up in 1929 in cooperation with the California Regional Office of the Forest Service to determine the effect of degree of slope on erosion of bare soil surfaces.

All tank installations are equipped with sprinkling systems for the application of artificial rain in order to augment the record from natural rainfall and particularly to manufacture heavier "storms" than are usual in the natural local rainfall.

Results A manuscript report on phase A has been submitted for publication by the University. A general progress report has been published in the American "Journal of Forestry".

2. Plot Experimentation

Purpose To measure, in place, the influence of mountain slope vegetation on surface run-off and erosion.

Status Plots are approximately 20x50 feet in size, the long dimension running down slope. A complete installation includes four such plots (arranged in pairs, one pair being denuded by fire, the other pair retaining its vegetative cover intact) and the necessary instruments for measuring and automatically recording rainfall and run-off for each plot. Four such complete installations are now under observation, three in chaparral types of southern California, and one in the brush woodland-yellow pine transition type on the Sierra National Forest.

Results For the first time definite quantitative information on the water retarding and erosion preventing effect of chaparral cover has been obtained experimentally. The data have been compiled in the form of tables, graphs and charts and have been presented before various scientific and engineering groups. The findings are destined to affect profoundly old concepts of forest influences. A progress report has been prepared and the results from the earliest installation have been briefly reported in the manuscript "Factors Affecting Surficial Run-off of Rain and Erosion of Soil Profiles".

Plans All installations are to be maintained under observation. Plans call for the extension of this phase of studies to the 30 important soil and vegetation types of the State of California.

3. Barranca Watershed Study

Purpose To develop satisfactory methods of measuring rainfall, run-off and erosion on a burned mountain watershed in the chaparral type, and to observe the recovery of vegetation and its effect upon run-off and erosion.

Status A 40-acre watershed in the south front of the San Bernardino Mountains, denuded by fire in 1925, was surveyed in 1927, and equipped with rain gages, and other meteorological instruments. A weir was installed in the canyon mouth to measure run-off, and below this an earth reservoir was built to trap eroded material. Thirty-six milacre

quadrats were established over the watershed to study the vegetative development.

In 1928 the weir, having proved useless on account of rapid silting of its basin, was replaced by a new water measuring device known as the Parshall flume, developed only a short time previously by an irrigation engineer of the Department of Agriculture. In 1929 a smaller Parshall flume was installed below the large one to record very small amounts of run-off without interfering with larger flows.

The succession quadrats have been charted and photographed annually and the results partially compiled. Airplane photographs of the watershed have been obtained through cooperation of the 23rd Aero Squadron, U. S. Army, at March Field.

Results The Parshall flume appears to offer a satisfactory means for measuring and automatically recording watershed run-off in a wide range of intensities and irrespective of the burden of eroded material carried by the water. The permeable earth reservoir has proven satisfactory for trapping and measuring eroded material in fairly large quantities. For very small quantities a supplementary device could be installed but this refinement is not warranted in the present project.

A large amount of rainfall and vegetative succession data has been accumulated.

Plans Continue observations of rainfall and vegetative succession until the cover is restored to approximate pre-fire conditions. Continue run-off observations through one or two more rain seasons. Complete compilation and analysis of accumulated data and prepare progress report.

It is intended ultimately to undertake a comparative study of one or two pairs of watersheds of 20 acres or more in area in the chaparral type, employing methods developed in the present study.

4. An Erosion Survey of California

The California Regional Investigative Committee at its last meeting authorized the making of an erosion survey of California jointly by the Forest Experiment Station and the Office of Grazing of the Regional Office. Special attention was directed to the condition and trend of use or abuse of the public domain, and the foothill regions under private ownership lying between cultivated lands and the national forests.

A preliminary survey has been completed of the San Joaquin Valley, in which erosion was found to be accelerated far above the normal on privately owned lands and the public domain by unrestricted and over grazing, by widespread fires, and by cultivation of steep slopes. In sections large areas were found seriously gullying, sufficiently so to render the reclamation of these lands uneconomical. In regions of light rainfall grazing without intelligent control may become a menace to agricultural regions into which the overgrazed lands drain. This extensive region in California now subject to unregulated use and inadequately protected from fire, presents a serious problem before the State.

Forestation Studies

The objectives of planting research in the northern and southern parts of the state are not identical. In the north the primary objective is the restocking, with commercial timber species, of areas deforested by fire or logging operations and not naturally restocking. In the south the chief purpose is the recovery of denuded slopes with a vegetative mantle to prevent destructive runoff and erosion but with no intention of producing a merchantable woody crop.

1. Northern California:

A small nursery is maintained at the Feather River Branch Station to produce stock for experimental planting in the pine region. Twelve plantations have been started, covering the following conditions:

- a. Forest land denuded by fire.
- b. Forest land denuded by high-lead logging.
- c. Brush land cleared by tractor and grader.

The species used are western yellow pine and Jeffrey pine in the form of two-year old transplants and two-year seedlings. Planting stock, surplus to research needs, is distributed to various national forests for administrative planting. In 1929 the nursery produced 52,000 one-year seedlings and 49,000 two-year transplants.

Owing to the death of Mr. Siggins last September this work cannot be greatly expanded until a permanent reassignment can be made. Examinations will be continued, however, and the plantations will be enlarged on a modest scale.

2. Southern California:

A nursery is maintained at the Devil Canyon Branch Station on land owned by the City of San Bernardino. Under formal agreement the land and water are supplied gratis by the City. Southern planting objectives are in part:

- (a) Recovery of denuded areas to check excessive runoff and erosion.
- (b) Determination of the possibility of improving the composition of the present cover either by increasing the proportion of desirable natives or by introduction of desirable exotics, whether trees, shrubs or lesser plants.

Test plantings of more than 60 species of trees and shrubs have been made since 1927. Stock not required for experiments has been distributed among the southern counties, the output for the past two years being:

| | | | | |
|------|-------------|-------|-------------|--------|
| 1929 | Experiments | 3500, | Distributed | 30,925 |
| 1930 | " | 6000, | " | 23,000 |

Cooperation is actively carried on with the Bureau of Plant Industry in the introduction of promising exotics, with the Eddy Tree Breeding Station in the intensive study of the genus Pinus, and with the Los Angeles County Forestry Department in planting experiments and seed collection. Seed exchange is also carried on directly with several foreign countries. Considerable extension work is done in distributing seeds, planting stock and planting advice to residents of the state.

Forest Products Studies

These studies are aimed primarily at the reduction of waste in lumber production and consumption, the analysis of marketing and other economic factors, including gathering of statistics. These contribute toward both the conservation of timber supply, as a national problem, and toward increasing the present unsatisfactory realization of the lumber industry, which constitutes one of the chief obstacles to the practice of constructive forestry by this industry.

1. Lumber Seasoning Stains

Purpose Study of these stains, which cause heavy damage in California pine lumber, and of various means for their prevention, in cooperation with Office of Forest Pathology, U. S. Bureau of Plant Industry, the Sugar Pine Lumber Company and manufacturers of various chemical preparations.

Status Field work completed 1927, 1928 and 1929. Lumber treated with various chemicals and inspected for degree of stain and degrade after drying. About 400 M feet observed. Progress report prepared 1928 for 1927 tests. All data now punched on cards for tabulating machine analysis; about 18,000 cards now at Forest Products Laboratory. To be summarized here this fall.

Plans Report to be prepared and articles written for lumber trade journals as soon as summaries are received from the laboratory.

Results Some chemicals very effective in reducing stain degrade, especially one compound made by Du Pont Company. Experiments prove that yard stains can be greatly reduced at low cost. Preliminary rough analysis showed reduction meaning savings as high as \$12.00 per M feet in grade of 1 & 2 clear dried under severe staining conditions.

2. White Fir

Purpose To determine the present stands, production and degree of utilization of white fir, and its

present and possible uses, with a view to increasing its economic value.

Status Studies of methods of production and of quantities and grades produced at mills and sold at retail yards, with factors affecting marketing and use of this species concluded and office report for this region completed.

Additional valuable data obtained last year in connection with woods-mill study and from special degrade and planer studies. Now punched for machine tabulation at Forest Products Laboratory.

Plans Preparation of Bulletin now under way at Forest Products Laboratory with California Office of Products cooperating. Trade magazine article on degrade and remanufacture now being written here. Other reports to follow this year and next spring.

Results Very promising prospects seem to be indicated that by better production and seasoning practice the realization from lumber of this species can be increased by more than the cost of the better practice, through a better product and satisfied purchasers. Correlation of paper manufacture with that of lumber, when feasible, would undoubtedly materially better the realization from white fir.

3. Lumber Depreciation

Purpose To work into a correlated whole, data on lumber depreciation from all causes, accumulated in detached studies during past years, so as to afford a consistent basis for National Forest timber appraisals and studies for bettering economic returns to the lumber industry.

Status Information from former studies in west side Sierra pine region now assembled and correlated with last depreciation study made 1929. Latter covered all grades and sizes, air dry and kiln dry, 33,000 boards tallied for degrade. Data have been summarized at Madison and are now being worked into reports and articles for publication.

Plans Series of articles to be started in western lumber journals within next two months. Detailed office report to follow. Further studies needed in East side pine region.

Results Computing not far enough along to give definite conclusions except for white fir. Degrade in latter runs from 4% to 40%, depending on size and grade. Much of this can be salvaged by proper remanufacture but the general practice seems to be to disregard these possibilities.

4. Woods and Mill Study

Purpose To determine the relative values, production costs and wastes in manufacturing different species and sizes of trees in the west side Sierra pine region so that economic facts will be available for application to the problems of forest management, silvicultural practices and cutting on privately owned lands.

Status Study planned and conducted last year. Data secured on pines, fir and cedar from stump to shipping platform. Nearly 4000 M feet of lumber tallied, preliminary computations completed and all figures transferred to punch cards at Forest Products Laboratory ready to be summarized within the next three months. Stands on three plots before and after logging tabulated by Office of Silvicultural Investigation ready for application of data to different cutting methods.

Plans Trade journal articles to be written for publication as soon as summaries are sent from Laboratory, and computations have been made. Coordinated office report covering all phases of project in detail will be prepared immediately upon completion of the series of papers for publication.

Results No results can be reported until machine tabulations of the 45,000 cards have been run and computed. Results of the depreciation phase of this project were discussed under "depreciation".

5. California Economic Research Council

Purpose Participation in the work of this Council through Mr. Hill as member of Executive Committee and Chairman of Standing Committee on Natural Resources, for the furtherance of research in the field of natural resources, this with a view particularly to its value in connection with problems of the forest resources.

Status During the past year the attention of the Natural Resources Committee has been directed chiefly to the land use problem.

Results The steps last year reported looking to extension and coordination by the State of snow survey activity, with a view to more accurate forecasting of the State's annual water crop, resulted in an appropriation by the Legislature. The State Engineer's office is now carrying on this work. Plans have been made and much interest aroused in a land use survey of the State. This will directly coordinate with the Forest Resources Survey project of the Forest Service when that shall reach California.

Plans Besides continuance of work on land use survey, in collaboration particularly with Professor David Weeks of the Giannini Foundation, action by the Economic Council and all other backing available will be enlisted to secure in the forthcoming State budget funds for the increased cooperation with the U. S. Geological Survey in completing the topographic mapping of California which failed 18 months ago because the budget had gone too far to permit inclusion of new items. The speeding up of the topographic mapping of the State is vitally necessary to prevent serious delay in the completion of the type map project now being carried on by this Station.

6. Statistical activities

Under this head are included the taking of the annual lumber and timber products census for California and Nevada, for and in cooperation with the U. S. Census Bureau; with which goes the collecting

of data on lumber distribution from California to other states and foreign countries, and on current stumpage prices; and the collection of data on current wholesale lumber prices.

Purpose: The object of these studies is to collect the data necessary to the industry and for statistical use generally in studies of lumber and timber economics.

Plans: These are all continuing projects, not likely to be discontinued, inasmuch as the Forest Service is able to secure both cheaper conduct of these inquiries because of its permanent local personnel, and more accurate statistical results because of its familiarity with regional lumber conditions and practice.

Cooperating Agencies

Of the numerous cooperating agencies referred to throughout this statement, two have representatives directly attached to the Experiment Station. These are the Bureau of Entomology and the Biological Survey.

Office of Forest Entomology

This office, maintained cooperatively at this Station by the Bureau of Entomology, is an important asset in rounding out the investigative work in forestry, not only because insect damage is in itself so widespread in our forests but because so many direct problems of the Station are intimately bound up with insect activity. Hitherto only one Bureau entomologist has been assigned to our Station, but in the near future the California headquarters of the Bureau are to be transferred from Stanford University to Berkeley and the entire personnel of the Bureau's California Staff will be housed with us. This arrangement is expected to result in increased attention to forest insect problems.

Corresponding with the overshadowing importance of bark beetles as causes of insect damage to California forests, these insects have occupied the major energies of the Forest Entomologists. Among the important studies

upon which they have been working in this State are the following:

1. Scrutiny of the effectiveness of previous control work in the Southern Oregon-Northern California Control Project, including the climatic, silvicultural and biological factors which influence the trend of bark beetle epidemics.
2. Development of biological control methods, by which the destruction of beneficial predator insects can be avoided and the helpful activity of these predators made use of.
3. Reduction of insect loss through marking. By observing the characteristics of beetle-infested trees this study aims to alter the marking practice in Forest Service timber sales so that it will remove trees most likely to be attacked by beetles. This study has reached the stage of testing the sample plot results on a larger scale in actual timber sales.
4. Attraction studies. These seek to determine what chemical substances make certain trees, for example those with lowered vitality, more attractive to bark beetles than normally vigorous trees. Such studies are important both in the development of effective baits for trapping the beetles, and in the detection of susceptible trees on timber sale areas as above discussed.
5. Relation between insects and fire damage. How and to what extent does fire injury of varying character and degree effect subsequent susceptibility of trees to insect attack under different conditions of site and treatment?

Among new studies scheduled for 1960 are:

1. Effect of logging operations upon bark beetle infestation. Large numbers of beetles are evidently removed with the logs taken out, and surrounding conditions are materially changed, especially as affecting breeding.

This project will include a special study of the interrelations of insects and logging slash.

2. Nutritional studies of the western pine beetle. Although a large amount of work has been done on the habits and control of this beetle, so little is known about its food requirements as to severely handicap other biological studies now under way or desired. The work should be vigorously pushed in the California pine region.

Office of Forest Biology

One representative of the Biological Survey has been assigned to this Station since 1928 by an arrangement similar to that in the case of the Forest Entomologist. Thus far, however, the Biological Survey has been unable to allot funds and personnel sufficient to relieve their representative here from absorption in the practical work of rodent control. While biological research on problems allied to Station projects has therefore been possible on only a limited and incidental scale, this has nevertheless been of much value. The presence of the Biologist at the Station has enabled him, in a consulting capacity, to contribute to the definition of problems and the development of working plans. Expansion of research in forest biology is greatly needed.

Two problems which are most urgent from the standpoint of direct Station work are:

1. The relation of rodents to tree seed destruction and the survival of seedlings in respect both to tree species and to brush and grass
2. The effect of animals, especially burrowing rodents, upon the structure and functioning of the soil profile in respect to water disposition.

Early attack in both of these lines is urgent to obtain results before the climatic cycle turns from

our long series of drouth years to a wetter period. The effect of rodent activity in both these directions may well be radically different under conditions of prolonged drouth than with the plentiful food and deeper soil moisture accompanying increased rainfall. There is every reason to expect that the climatic cycle will soon turn to wetter years, and it might then be impossible to study these problems under drouth conditions within another fifteen years.

Offices of Forest Pathology and Blister Rust Control

These two units of the U. S. Bureau of Plant Industry maintain offices in California. The Pathological Office has been of the utmost importance to the development of forestry knowledge and practice in this region. It cooperates heartily with this Station, as well as with the administrative organization of the Forest Service in San Francisco where the Pathological offices are quartered. The Blister Rust offices are quartered at the University but not with this Station. No disease menace to the forests of California has more serious potentialities in respect to effect upon forest management than the white pine blister rust, when its apparently inevitable march toward the sugar pine of California arrives. There is the greatest cordiality in relations between this Station and the Blister Rust representative.